REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 12-22 are in the case.

I. THE FORMAL REJECTION

Claim 12 stands rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Action asserts that claim 12 is rendered indefinite in view of the recitation "substantial condensation" which, the Action asserts, is not defined in the claim and that it is allegedly unclear as to the amount of condensation which allows it to be substantial. The Action goes on interpret the phrase "substantial condensation" based on the ranges expressed in claims 15 and 17, although the Action points out that if this was expressly used as the definition of the phrase, then these claims would be improper. The rejection is respectfully traversed.

The interpretation of the phrase "substantial condensation" as based on the ranges expressed in claims 15 and 17 is not correct. The ranges present in claims 15 and 17 refer to the ratio of the comonomer (octene or decene) to ethylene present in the process. The proper interpretation of "substantial condensation" would have been clear to one of ordinary skill in this art as of the filing date of the application. This is explained in detail below.

The amount of condensation considered to be "substantial" is dependent on the operation temperature and the boiling point of the α-olefin. Use of this concept in conjunction with a single site catalyst that can incorporate very high levels of

comonomer (at low comonomer reactor inventories) can lead to a process which can produce resins without encountering reactor operational difficulties.

In the presently claimed copolymerisation process, the process is operated in "condensed mode" and the amount of the α-olefin is maintained below that at which "substantial condensation in the reactor" occurs. The expressions "condensed mode" and "substantial condensation in the reactor" are discussed below.

A process operating in "condensed mode" requires either the comonomer or an inert compound to be cooled and returned to the reactor as a liquid in order to provide improved cooling of the fluidized bed. Such "condensed mode" operation is defined In the present specification at page 2, lines 28–31 as:

> "...the process of purposefully introducing a recycle stream having a liquid and a gas phase **into the reactor** such that the weight percent of liquid based on the total weight of the recycle stream **is greater than about 2.0 weight percent**." (Emphasis added)

Thus, with respect to the process of claim 12, the phrase "operating in condensed mode" refers to the above-defined process of introducing a recycle stream having a liquid and a gas phase "**into the reactor**".

The claim goes on to refer to the level of condensation **in the reactor** and this is controlled by the amount of comonomer and the temperature and partial pressure in the reaction zone. Thus, the term "substantial condensation in the reactor" would be understood by the skilled artisan to mean condensation at any noticeable level, i.e. > 0.5% liquid, in the reactor.

Another way to understand the differences with respect to "condensed mode" and "substantial condensation in the reactor" is by reference to the temperature

differentials in the recycle stream and the reactor. Thus, with respect to "condensed mode" operation, this is realized by the temperature gradient between the temperature of the recycle stream and the dew point of the recycle stream. For example, the dew point of the recycle stream may be increased by the addition of a condensible fluid to the recycle stream which is inert, such as pentane or hexane. Thus, a typical example of operation in "condensed mode" would comprise the addition of 5.4 mol% pentane into the recycle stream to provide a dew point temperature of 69.5^{O}C with a reactor inlet temperature of 48.8^{O}C, resulting in a level of condensation in the recycle stream entering the reactor of 11.3% (values taken from Table 1 of EP 699213 referenced at page 2 line 33 of the present application).

With regard to "condensation in the reactor", this is realized by the temperature differential between the polymerization temperature in the reactor and the dew point temperature of the fluidizing gas at the reactor pressure (monomer, hydrogen, comonomer, e.g., octane, and inert). The boiling point of 1-octene is 121^{O}C., and its presence in the gas phase composition will significantly increase the dew point temperature of the mixture.

Hence, given that the polymerization temperature in the reactor may typically be in the range 70-90^{O}C., in the present invention, the amount of comonomer is maintained at such a level that no substantial condensation occurs in the reactor. The amount of octene, for example, may be such that the 1-octene/ethylene partial pressure is between 0.0001 and 0.02 and, typically, between 0.002 and 0.015 (see page 3, lines 27–28 of the present application). The comonomer concentration in the gas phase should be such that the dew point temperature of this fluidization gas at the reactor

pressure is lower than the polymerization temperature to ensure a gas phase operation **without** substantial condensation in the reactor.

In the present invention, the use of a single site catalyst (such as a metallocene) can incorporate very high levels of comonomer at the above low comonomer reactor inventories and this can lead to a process which can produce resins without encountering reactor operational difficulties. In particular, by maintaining the amount of 1-octene low, several advantages may be observed. Thus, the presence of a liquid phase in the reactor which is rich in comonomer would tend to lead to local heterogeneity with the formation of very low density material which potentially and undesirably leads to the formation of agglomerates.

The present invention on the other hand enjoys several advantages as follows:

easier powder degassing;

more efficient hydrocarbon use;

higher ethylene partial pressures and improved catalyst productivity;

less physical adsorption of hydrocarbons on polymer powder;

better flowability of the polymer due to less sticky polymer;

reduced agglomeration in the reactor.

Based on the above, it is clear that no indefiniteness arises with regard to the expression "substantial condensation" as used in the present application. Withdrawal of the formal rejection is respectfully requested.

II. THE ANTICIPATION RERJECTION

Claims 12, 14-16 and 18 stand rejected as allegedly anticipated by US 2003/0171206 (Murray). This rejection is respectfully traversed.

Claim 12 claims a process for the copolymerization of ethylene and an α-olefin having 7 to 10 carbon atoms in a fluidized bed gas phase reactor in the presence of a single site polymerization catalyst. The process is carried out in condensed mode, and the amount of the α-olefin is maintained below that at which substantial condensation in the reactor occurs.

As noted above, claim 12 requires that the polymerization process is carried out in "condensed mode". Murray contains no disclosure of operating in "condensed mode". Murray describes a typical gas phase polymerization process in which heat is removed from the system by cooling of the recycle stream (Murray, pages 10 and 11). This is the basic fluidized bed polymerization process.

On the other hand, "condensed mode" operation, as defined at the bottom of page 2 of the present specification, refers to the process of purposefully introducing a recycle stream having a liquid and a gas phase into the reactor such that the weight percent of liquid based on the total weight of the recycle stream is greater than about 2.0 weight percent. This not disclosed in Murray. In addition, there is no disclosure in Murray of operation in condensed mode or of the specific use of higher α-olefins, both of which are required features of the claimed process.

Absent any disclosure in Murray of these claimed features, it is clear that Murray is not anticipatory of the presently claimed invention. Withdrawal of the anticipation rejection is respectfully requested.

III. THE OBVIOUSNESS REJECTION

Claims 13, 15 and 18-19 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Murray, on the ground that if the range of claim 15 is not sufficiently specific to anticipate claim 15, it allegedly would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the range described by Murray. This rejection is respectfully traversed.

It has been discovered surprisingly, according to the present invention, that in order to operate copolymerizations using higher α-olefins as comonomers in condensed mode operation, it is advantageous to operate the process such that the amount of the α-olefin is maintained below that at which substantial condensation in the reactor occurs. Thus, the claimed process is operated under condensed mode of operation by use of, for example, a suitable inert substance in the recycle stream and under conditions such that the amount of the α-olefin (e.g., octene) is maintained below that at which substantial condensation in the reactor occurs.

As discussed above by use of the process conditions of the present invention, higher α-olefins may be successfully employed in a gas phase process provided the amount of higher α-olefin comonomer is maintained below that at which substantial condensation occurs. Such operation is also dependent upon the operation temperature and the boiling point of the higher α-olefin and the process is particularly advantageous when performed in the presence of catalysts able to incorporate high levels of comonomers at low comonomer inventories.

Murray relates to solution, high pressure, slurry or gas phase processes and comonomers having from 3 to 15 carbon atoms. It appears that all of the Examples in Murray are performed either in solution or in slurry using 1-hexene as the commoner. There are no examples of copolymerization in a gas phase fluidized bed reactor using a comonomer having 7 to 10 carbon atoms. Murray constitutes a very general disclosure with respect to the polymerization process, and does not highlight operation in the gas phase and in condensed mode, as required by the presently claimed invention.

At page 10 (paragraph [0119]), Murray discloses the mole ratio of comonomer to ethylene is between about 0.0001 to 0.2 and preferably between 0.002 and 0.008. This disclosure must, however, be generally seen as applicable to polymerization in solution, high pressure, slurry or gas phase processes. Murray provides no suggestion with respect to the use of higher α-olefin comonomers as in the present invention. It is noted also that the ratios of comonomers to ethylene disclosed in Murray are higher than those disclosed in the present invention.

In light of the above, it is clear that Murray does not suggest the presently claimed invention. Withdrawal of the obviousness rejection based on Murray alone is respectfully requested.

Claim 17 stands rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Murray in view of Muhle *et al.* (US 6,180,736) (Muhle). Claim 17 relates to the copolymerization of ethylene and 1-decene by defining the partial pressure ratio. The Action considers that Muhle discloses minimizing the higher alpha-olefin content to reduce agglomeration and, hence, in combination with Murray renders claim 17 as lacking inventive step. This reasoning is respectfully traversed.

Muhle describes (see: col. 2, lines 60-67) that, for gas phase processes operating in condensed mode, it is desirable to minimize the concentration of α-olefin necessary to achieve a given polymer density, and that the ability to use less α-olefin permits higher levels of condensed liquid to be employed in condensed mode which, in turn, permits higher production rates. However, there is no suggestion in Muhle with respect to the use of higher α-olefins as required in the presently claimed process.

The Action refers to the "obvious" use of octene and decene at lower quantities based on their boiling points and the teachings in Muhle. In col. 12 of Muhle, a wide list of comonomers is disclosed and the examples use hexene as the comonomer. However, this analysis is clearly based on hindsight, given knowledge of the present invention, and is not based on the understanding of the skilled person from a reading of Muhle. The presently claimed invention is clearly not rendered obvious in light of Murray and Muhle. Withdrawal of this obviousness rejection is respectfully requested.

Claims 19-20, and 22 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Murray and further in view of Babb *et al.* (US 6,627,573) (Babb). Claim 21 stands rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Murray in view of Devore *et al.* (US 5,470,993) (Devore) and further in view of Babb.

The Action refers to the disclosure of higher α-olefins at column 22 of Babb. However, this disclosure is part of a very general list of suitable comonomers and does not constitute a specific disclosure with respect to the comonomers of the present invention. Babb also discloses (see col. 22) condensed mode operation. The examples in Babb, however, are directed to gas phase polymerizations in an autoclave using hexene as comonomer.

With regard to the rejection of claim 21, the combination of Babb or Devore (both essentially used to disclose suitable catalysts) with Murray fails to suggest the presently claimed invention. Neither Babb nor Devore discloses or suggests the specific use of higher α-olefins as required in the present invention. For example, Babb (see col. 22, lines 13–24) mentions higher α-olefins but exemplifies them as 1-butene, 1-hexene and 4-methyl-1-pentene which are not those covered by the claims of the present invention (α-olefins having 7 to 10 carbon atoms).

The cited art, taken alone or in any combination, fails to suggest operation of a process in condensed mode together with the use of α-olefins having 7 to 10 carbon atoms and wherein the amount of the higher α-olefin is maintained below that at which substantial condensation in the reactor occurs. Withdrawal of the prior art rejections is therefore respectfully requested.

Favorable action is awaited.

Respectfully submitted,

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